2003 Critical Review

Wednesday, June 25
8:30–11:30 a.m.

Separation and Capture of CO_2 from Large Stationary Sources and Sequestration in Geological Formations—Coalbeds and Saline Aquifers

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This year's Critical Review will begin by introducing the topic of global warming, including a description of greenhouse gases and their linkage to rising average temperatures. The greenhouse effect will be described and the historical aspects of its development will be briefly delineated, including a description of the contributions by Tyndall, Fourier, Arrhenius, and others. The concept of climate change will be introduced and defined according to the United Nations Framework Convention on Climate Change. The relationship between rising average global temperatures and rising atmospheric CO_2 concentrations will be clearly delineated using information from the Intergovernmental Panel on Climate Change. Anthropogenic CO_2 emissions sources will be listed, along with estimates of the amount of CO_2 stored via terrestrial sequestration in the United States. The carbon cycle will be briefly discussed. The Kaya identity will be introduced, along with a description of a plan to reduce CO_2 emissions. The plan includes increased conservation, development of advanced zero-emissions fossil-fuel-based electric power generating plants that have improved efficiencies by developing and deploying electric appliances that use less energy, and by switching to less-carbon-intensive fuels, such as natural gas and hydrogen, renewable forms of energy, and nuclear power. In addition, the plan envisions the separation and capture of CO_2 from large point sources and the subsequent transportation and storage of the CO_2 in the geosphere and the ocean.

The review will cover various aspects of CO_2 separation and capture from fossil fuel combustion and gasification facilities. Separation and capture of CO_2 from both flue gas and fuel gas using wet scrubbing technologies, dry regenerable sorbents, membranes, cryogenics, pressure and temperature swing adsorption, physical solvents, and advanced concepts will also be described.

Existing commercial CO_2 capture facilities at electric power generating stations based on the use of monoethanolamine will be described. The Rectisol process used by Dakota Gasification to separate and capture CO_2 will be reported. The Weyburn enhanced oil recovery project, which is operated by Pan Canadian Petroleum Ltd. and uses the CO_2 captured at Dakota Gasification for enhanced oil recovery, will be presented. The CO_2 production capacity at Dakota Gasification is in excess of 200 million standard cubic feet per day.

Two technologies for storage of the captured CO_2 will be reviewed: sequestration in deep unmineable coalbeds with concomitant recovery of methane, and sequestration in deep saline aquifers. The estimated storage capacity of U.S. coals will be delineated, along with a description of gas storage mechanisms on coal. The physical and chemical phenomena that occur when CO_2 is injected into a coal seam will be described. Finally, sequestration of CO_2 in brinefields will be examined, including a description of their estimated storage capacity. The physical, chemical, and geological phenomena that are expected to occur when CO_2 is injected into a brinefield will also be outlined.

The 2003 Critical Review will be presented by Dr. Curt M. White, carbon sequestration science focus area leader at the National Energy Technology Laboratory, Pittsburgh, PA. Dr. White has more than 30 years of industrial, government, and academic research experience in the area of fossil fuel science, including polycyclic aromatic hydrocarbon chemistry, the analytical chemistry of fossil fuels, the geochemistry of sulfur in fossil fuels, and supercritical fluid technologies, such as extraction and chromatography. The Review will be published in the June 2003 issue of the *Journal of the Air & Waste Management Association* and presented by Dr. White at A&WMA's 96th Annual Conference & Exhibition in San Diego, CA, on June 25.

Anyone interested in global warming, climate change, capture of CO_2 from large point sources, and storage of the CO_2 in the geosphere is invited to read and comment upon the Critical Review, and to participate in the question and answer portion of the presentation.